Thyroid lobectomy for treatment of well differentiated intrathyroid malignancy

Iain J. Nixon, MD,[a] Ian Ganly, MD, PhD,[a] Snehal G. Patel, MD,[a] Frank L. Palmer, BA,[a] Monica M. Whitcher, BA,[a] Robert M. Tuttle, MD,[b] Ashok Shaha, MD,[a] *and* **Jatin P. Shah, MD,[a]** *New York, NY*

Background. *There remains controversy over the type of surgery appropriate for T1T2N0 well differentiated thyroid cancers (WDTC). Current guidelines recommend total thyroidectomy for all but the smallest lesions, despite previous evidence from large institutions suggesting that lobectomy provides similar excellent results. The objective of this study was to report our experience of T1T2N0 WDTC managed by either thyroid lobectomy or total thyroidectomy.*

Methods. *Eight hundred eighty-nine patients with pT1T2 intrathyroid cancers treated surgically between 1986 and 2005 were identified from a database of 1810 patients with WDTC. Total thyroidectomy was carried out in 528 (59%) and thyroid lobectomy in 361 (41%) patients. Overall survival (OS), disease-specific survival (DSS) and recurrence-free survival (RFS) were determined by the Kaplan-Meier method. Factors predictive of outcome by univariate and multivariate analysis were determined using the log rank test and Cox proportional hazards method respectively.*

Results. *With a median follow-up of 99 months, the 10-yr OS, DSS, and RFS for all patients were 92%, 99%, and 98% respectively. Univariate analysis showed no significant difference in OS by extent of surgical resection. Multivariate analysis showed that age over 45 yr and male gender were independent predictors for poorer OS, whereas T stage and type of surgery were not. Comparison of the thyroid lobectomy group and the total thyroidectomy group showed no difference in local recurrence (0% for both) or regional recurrence (0% vs 0.8%,* P = .96*).*

Conclusion. *Patients with pT1T2 N0 WDTC can be safely managed by thyroid lobectomy alone. (Surgery 2011;■:■-■.)*

From the Department of Head and Neck Surgery[a] and Department of Endocrinology,[b] Memorial Sloan Kettering Cancer Center, New York, NY

The incidence of thyroid cancer is rising,[1,2] in part due to detection of incidental thyroid cancer by the increased use of radiologic imaging, such as ultrasonography, computed tomography (CT), and magnetic resonance imaging in medical practice.[3] This increase is mainly in low risk intrathyroidal T1T2 tumors. This has resulted in a rise in the number of thyroidectomies carried out in the United States[1-3] in addition to an increased use of adjuvant radioactive iodine therapy (RAI). This increase in total thyroidectomy operations and use of RAI has created much controversy in recent times, because many groups suggest that low risk patients with unilateral intrathyroidal T1T2 tumors are being over-treated. There is controversy as to whether or not such patients should be managed by thyroid lobectomy alone. Over the past decade, there are several reports in the literature that provide evidence supporting thyroid lobectomy as being equivalent to total thyroidectomy in terms of survival and recurrence.[4-6] Other studies by Loh et al[7] and Mazzaferri and Jhiang,[8] however, have reported increased recurrence in those patients managed by thyroid lobectomy. Furthermore, a recent analysis of the Surveillance Epidemiology and End Results (SEER) database by Bilimoria et al[9] also suggested increased recurrence in lobectomy patients. Indeed, the Bilimoria data was taken into account when the American Thyroid Association (ATA) published the current ATA guidelines[10] recommending total thyroidectomy for all well differentiated thyroid cancers (WDTC) over 1 cm. The ATA guidelines also suggest that thyroid lobectomy be considered only if disease is limited to the

Accepted for publication August 16, 2011.

Reprint requests: Jatin P. Shah, MD, Department of Head and Neck Surgery, Memorial Sloan Kettering Cancer Center, 1275 York Avenue, New York, 10065. E-mail: shahj@mskcc.org.

0039-6060/$ - see front matter

doi:10.1016/j.surg.2011.08.016

thyroid gland and under 1 cm in a low risk patient. The Bilimoria study, however, has come under criticism and as a consequence the controversy on this issue remains unresolved. The objective of our study was therefore to revisit the issue of thyroid lobectomy by examining a more contemporary dataset of WDTC patients managed at Memorial Sloan Kettering Cancer Center (MSKCC) between the years 1986 and 2005.

METHODS

Following approval by the Institutional Review Board, 889 patients (49%) who had thyroid surgery for T1T2 N0 cancer (using the 2009 AJCC staging manual[11]; T1: <2 cm, T2: 2–4 cm) between 1986 and 2005, were identified from our institutional database of 1810 patients treated for WDTC at MSKCC. Patients who underwent initial treatment elsewhere prior to referral or those who were considered unresectable at the time of referral were excluded.

Data collected included patient demographics, surgical details including extent of thyroid surgery, the presence of gross extrathyroid extension or residual disease on completion of surgery. Histopathologic details recorded included tumor histology, size, and presence of extrathyroid extension. Postoperative treatment details recorded were use of radioactive iodine. Based on clinical and pathology features, patients were classified into low, intermediate, and high risk for death according to patient and tumor factors.[12] Patients were classified as low risk of death if they presented before the age of 45 years and high risk if over 45 years. Tumors were classified as high risk if staged as pT3/4, if they presented with evidence of distant metastases, or if found to be high grade. A case is classified as low risk if a low risk patient presents with a low risk tumor and high risk if a high risk patient presents with a high risk tumor. Intermediate risk cases are classified as either low risk patients with a high risk tumor, or high risk patients with a low risk tumor. All patients with distant metastases or extrathyroid extension were excluded from this analysis. Patients who present with early intrathyroid WDTC, including all patients in this cohort, are not routinely investigated preoperatively for the presence of distant metastases. Therefore, the only patients classified as high risk were patients over the age of 45 years with follicular or Hürthle cell carcinoma, based upon capsule and vascular invasion. In the absence of nodular disease in the contralateral lobe, the recommended treatment for cases considered low risk in our institution is thyroid lobectomy, reserving total thyroidectomy for high risk cases, and those with contralateral nodularity. Intermediate risk cases are dealt with on a case-by-case basis following informed consent.

In the cohort of patients from 1986 to 2005, preoperative ultrasonography was not used for assessment of the central and lateral neck nodes. The assessment of the lateral neck nodes was based on preoperative clinical examination and if enlarged, ultrasonography was carried out. Assessment of the central compartment for all patients was intraoperative by palpation of the central compartment lymph nodes at the time of thyroidectomy. If no palpable nodes were present in the central compartment, then no central compartment neck dissection was done. If nodes were palpable, then a central compartment neck dissection was carried out. All patients with pathologic evidence of metastatic central or lateral neck disease were excluded from this analysis. Therefore, all patients in our study were N0.

Outcomes data included local, regional, and distant recurrence as well as details of death. Local and regional recurrence were determined by clinical examination supplemented with ultrasonography. During the time period of the study from 1986 to 2005, routine use of serum thyroglobulin was not available and this was not used in follow-up to assess recurrence. Similarly, annual ultrasonography was not introduced into our practice until 2005. The presence of local or regional recurrence following treatment was based on cytologic or histopathologic evidence of disease. Local recurrence was defined as recurrent disease located in the operated thyroid bed confirmed by cytologic sampling or histologic analysis following further surgery; the development of contralateral disease following lobectomy was classified as a second primary tumor rather than a local recurrence. Regional recurrence was defined as recurrent disease found in cervical lymph nodes, confirmed again by cytologic sampling or histopathology following subsequent surgical resection. Distant disease was determined by imaging studies including radioiodine uptake scans, CT scans, positron emission tomography scans, or cytologic and histopathologic evidence where available.

Disease-specific outcomes were calculated using the date of last follow-up with the treating surgeon or endocrinologist at MSKCC. Overall survival was calculated using records received from the patient or any physician involved in the patient's care, then cross checked against the social security index. Details of death were determined from death certificates and hospital records where available. All patients who had evidence of active disease at

Table I. Patient, tumor and treatment characteristics

Characteristics (N = *889*)	n *(%)*
Age	
<45 yr	425 (48)
>45 yr	464 (52)
Gender	
Male	188 (21)
Female	701 (79)
pT stage	
T1	637 (72)
T2	252 (28)
Pathology	
Papillary	800 (90)
Follicular	52 (6)
Hürthle cell	37 (4)
Risk group	
Low	374 (42)
Intermediate	457 (51)
High	58 (7)
Surgery	
Lobectomy	361 (41)
Total thyroidectomy	528 (59)

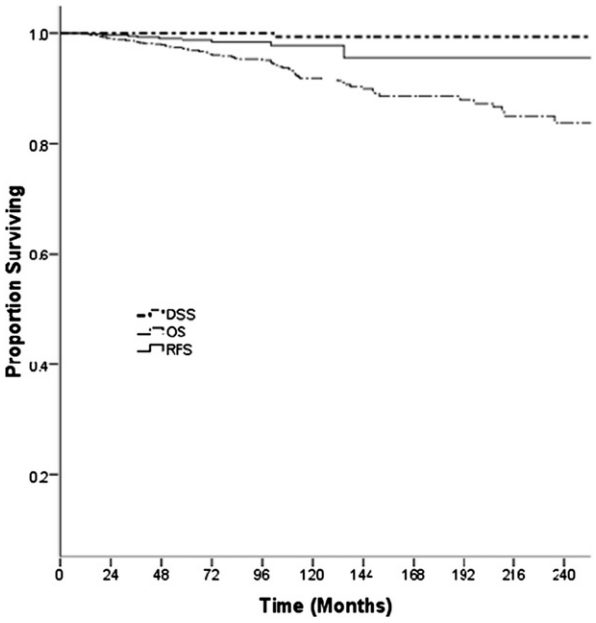

Fig 1. Overall survival (OSS), disease-specific survival (DSS), and recurrence-free survival (RFS) of the entire group.

the time of last follow-up and died during follow-up were considered to have died of disease. The median follow-up for the entire patient cohort was 99 months (range, 13–291). Outcomes data were therefore calculated at 10 years, because this represented the time point at which approximately 50% of patients were still available for follow-up and 50% of patients had either been lost to follow-up or died. Statistical analysis was carried out using JMP statistical package (SAS, Cary, NC) and SPSS (IBM, Chicago, IL). Variables were compared within groups using the Pearson chi square test. Survival outcomes were analyzed using the Kaplan-Meier method. Univariate analysis was carried out by the log rank test and multivariate analysis by Cox proportional hazards method.

RESULTS

Entire group. The male to female ratio was about 2:7 (188 men and 701 women). The median age was 46 years (range, 4–91). Eight hundred patients (90%) had papillary carcinoma, 52 patients (6%) had follicular carcinoma, and 37 (4%) had Hürthle cell carcinoma. Nineteen patients were classified as having tall cell variant of papillary carcinoma. Although tall cell variant does have a slightly poorer outcome,[12] we still consider this in the WDTC category.

Patient, tumor, and treatment details are shown in Table I. In our group of patients, total thyroidectomy was carried out in 507 (57%) and thyroid lobectomy in 382 (43%) patients. No patients had residual gross disease on completion of the procedure. Twenty-one of the 382 patients (6%) treated with initial lobectomy had immediate completion thyroidectomy. The indications for completion thyroidectomy were patient preference in 8 cases (38%), large size of primary lesion in 4 (19%) and multicentric disease in 3 patients (14%). Positive margins, previous exposure to radiation and the later disproven suspicious of distant metastases were the reason for completion in 1 case each (5%). For the remaining 3 cases, the reason for completion surgery was not recorded. These patients were considered as total thyroidectomy for the purposes of outcomes analysis, leaving 528 patients (59%) coded as total thyroidectomy and 361 (41%) patients coded as thyroid lobectomy.

Six hundred thirty-seven patients were pathologically pT1 (83%) and 252 patients were pT2 (17%). All patients had no evidence of cervical or distant metastases. Sixty-seven patients (8%) had central neck dissection, 3 had lateral neck dissection only (<0.5%), and a further 4 had central and lateral neck dissections (<0.5%) due to clinical or radiologic suspicion of neck metastases. None of these neck dissection specimens were found to contain metastatic thyroid carcinoma, however. Of the 7 neck dissections that included lateral neck

levels, three were performed when thyroid cancer co-existed with another malignancy in the lateral neck nodes (1 metastatic breast cancer, 1 metastatic malignant melanoma, and 1 squamous cell carcinoma with metastases to the neck). Two had needle biopsy evidence of metastatic malignancy on outside cytology, but following lateral neck dissection, no evidence of thyroid cancer was detected on histopathologic analysis. One patient had clinically suspicious nodes on intraoperative examination; however, the nodes were histopathologically free of disease, and in 1 patient, treated in 1993, no further preoperative details were available. Our current departmental policy to minimize the number of neck dissection specimens that do not contain disease includes ultrasonographic analysis of the central and lateral nodal compartments with ultrasonography-guided fine needle aspiration cytology of suspicious nodes. No patients had distant metastatic disease on preoperative staging or postoperative RAI scan.

Using the MSKCC risk group stratification system, 374 patients (42%) were classified as being at low risk of death, 457 (51%) as intermediate risk, and 58 (7%) as high risk (due to presentation with follicular or Hürthle cell carcinoma over the age of 45 years) in accordance with our previously published risk group stratification.[13]

With a median follow-up of 99 months (range, 13–291) the overall survival (OS), disease-specific survival (DSS), and recurrence-free survival (RFS) at 10 years were 92%, 99%, and 98%, respectively (Fig 1). There were 68 deaths, but only one was due to thyroid cancer. There were no local recurrences in the operated thyroid bed, 6 neck recurrences, and 5 distant recurrences. The 10-year local RFS, regional RFS, and DSS were 100%, 99%, and 99%, respectively. Fourteen patients (4%) who underwent thyroid lobectomy had a completion thyroidectomy at a later date due to the development of contralateral nodules. The median time to completion thyroidectomy was 69.5 months (range, 6–181). Of the 14 patients, 7 (50%) had a malignancy of the same histologic subtype, in the contralateral lobe, 2 (14%) had a malignancy of different histologic subtype, and 5 (36%) had benign disease.

Factors predictive of overall survival by univariate analysis are shown in Table II. Age over 45 years, male gender, and stratification as intermediate/high risk patients were predictive for worse outcome. Histology and type of surgery were not significant. Multivariate analysis of male gender, age >45, T stage, and surgical procedure showed that age over 45 years and male gender remained independent predictors of worse overall survival (hazard ratio 3.9 and 1.9, respectively), whereas both T stage and type of surgery were not. Risk groups were not used in the multivariate analysis, because they are based on groups of individual variables.

Lobectomy and total thyroidectomy groups. Patient characteristics, tumor characteristics, and outcomes stratified by type of thyroid surgery are shown in Table III. The median age of patients was 44 years (range, 4–91) in the lobectomy group and 48 years (range, 11–85) in the total thyroidectomy group. As expected the lobectomy cohort had more patients under the age of 45 years (54% vs 44%, $P = .002$), fewer patient with papillary cancer (86% vs 93%, $P < .001$) and fewer patients treated with radioactive iodine (0.3% vs 37%, $P < .001$) compared to the total thyroidectomy patients.

No significant differences in 10-year OS or DSS were found between thyroid lobectomy and total thyroidectomy patients (93% vs 92%, $P = .64$ and 100% vs 98.5%, $P = .246$ respectively). Table IV shows the 10-year overall survival rates for lobectomy and total thyroidectomy groups stratified by pT stage, pathologic tumor size, and risk group. The 10-year survival rates for thyroid lobectomy and total thyroidectomy were 92% vs 89% for T1 lesions ($P = .78$) and 96% vs 94% for T2 lesions ($P = .62$). When we stratify overall survival by tumor size the 10-year survival for patients with tumors under 1 cm, 1–2 cm, 2–3 cm, and 3–4 cm was not significantly different in patients treated with lobectomy vs total thyroidectomy (1 cm: 89% vs 93% ($P = .27$), 1–2 cm: 94% vs 87% ($P = .11$); 2–3 cm: 98% vs 94% ($P = .93$), and 3–4 cm: 94% vs 92% ($P = .53$), respectively. Figure 2 shows Kaplan Meier plot of overall survival by surgical treatment, stratified by pT size (less than 1 cm and over 1 cm).

The 10-year overall survival for the low, intermediate, and high risk groups was also not statistically different for thyroid lobectomy vs total thyroidectomy. Low risk, 97% vs 96% ($P = .58$); intermediate risk, 90% vs 85% ($P = .36$), and high risk, 90% vs 96% ($P = .35$), respectively.

For recurrence, we also found no significant difference in 10-year outcomes between thyroid lobectomy and total thyroidectomy. Local recurrence was 0% in both groups and regional recurrence was 0% vs 0.8%, respectively, $P = .96$. The 10-year distant recurrence rate in patients treated with thyroid lobectomy was 0% vs 3% in the total thyroidectomy group. This difference may be due to the fact more patients were over 45 years of age in the total thyroidectomy cohort.

Table II. Factors predictive of overall survival

Variable	*Patients* n *(%)*	*10-yr survival %*	*Univariate analysis* P *value*	*Multivariate analysis*	
				HR (CI)	P *value*
Age					
<45 yr	425 (48)	96	<.01		
>45 yr	464 (52)	88		3.9 (2.1–7.0)	<.01
Gender					
Female	701 (79)	93	.01		
Male	188 (21)	89		1.9 (1.1–3.2)	.01
pT stage					
T1	637 (72)	91	.15		
T2	252 (28)	95		0.722 (0.4–1.3)	.258
Pathology					
Papillary	800 (90)	92	.78	NS	NS
Follicular	52 (6)	94			
Hürthle cell	37 (4)	94			
Risk group					
Low	374 (42)	97	<.01	N/A	N/A
Intermediate	457 (51)	88			
High	58 (7)	93			
Surgery					
Lobectomy	361 (41)	93	.64	0.996 (0.6–1.6)	.989
Total thyroidectomy	528 (59)	91			

HR, Hazard ratio; *CI*, confidence interval.

In comparison with the group of patients treated with initial lobectomy, the 14 patients who required completion thyroidectomy at a later date were similar in terms of age, gender distribution, pT stage, provision of postoperative RAI and risk group (Table V). Only 1 of the 14 patients had positive margins reported on histopathology.

DISCUSSION

The surgical management of WDTC is based upon reports from retrospective data from both single institutional datasets and national cancer registries. It is well recognized that prospective, randomized controlled trials of therapy for thyroid cancer are impractical. The excellent survival outcome of patients would require large sample sizes and long follow-up to detect the small therapeutic advantages.[14]

Management of WDTC confined to the gland (T1T2) forms a significant part of surgical thyroid oncologic practice accounting for almost 50% of our practice. The approach to surgical management of such low risk patients within our institution is to offer thyroid lobectomy as an alternative to total thyroidectomy in properly selected low or intermediate risk patients. We currently recommend total thyroidectomy for patients with nodules in the contralateral lobe (over 0.5 cm detected clinically or on ultrasonography), clinically significant lymph node metastasis, gross extra thyroidal extension and evidence of distant metastasis. Increased availability of high definition preoperative ultrasonography has resulted in increased detection of contralateral nodules and this has resulted in a higher rate of total thyroidectomy carried out in recent years compared to the past (rising from 30% to around 75% over the duration of this study). Despite this trend, 362/884 (41%) of patients in this cohort were treated with thyroid lobectomy.

Our management strategy is based upon evidence from our institution,[4] as well as others,[5,15-17] suggesting that there is no survival improvement by total thyroidectomy over lobectomy in properly selected, low risk patients. In our first report in 1993 on a matched pair analysis of thyroid lobectomy vs total thyroidectomy patients, we reported similar outcome for low risk and intermediate risk patients with tumors up to 4 cm in size.[4] Since then, other authors have reported similar results. For example, Sanders and Cady[6] reviewed their experience of over 1000 patients and found no difference in survival or recurrence rates according to extent of surgical resection when patients who underwent biopsy alone were removed from the unilateral surgery group. A similar outcome was reported by the Mayo group; over 6 decades of management of papillary thyroid cancers at the Mayo Clinic, there was no reduction in survival or increased recurrence in the lobectomy patients

Table III. Patient characteristics, tumor characteristics, and outcomes stratified by surgical group

Variable	*Lobectomy* n = *361* n *(%)*	*Total thyroidectomy* n = *528* n *(%)*	P *value*
Age			
<45 yr	195 (54)	230 (44)	.002
>45 yr	166 (46)	298 (56)	
Gender			
Male	82 (23)	106 (20)	.345
Female	279 (77)	422 (80)	
pT stage			
pT1	249 (69)	388 (73)	.143
pT2	112 (31)	140 (27)	
RAI			
No	360 (99.7)	333 (63)	<.001
Yes	1 (0.3)	195 (37)	
Pathology			
Papillary Ca	310 (86)	490 (93)	<.001
Follicular Ca	36 (10)	16 (3)	
Hürthle cell Ca	15 (4)	22 (4)	
10-yr local recurrence	0 (0)	0 (0)	1
10-yr neck recurrence	0 (0)	5 (0.8)	.96
10-yr distant recurrence	0 (0)	5 (3)	.05
10-yr deaths of any cause	18 (7)	27 (9)	.64
10-yr disease-specific deaths	0 (0)	1 (1.5)	.246

RAI, Radioiodine ablation.

Table IV. 10-year overall survival for lobectomy and total thyroidectomy groups stratified by pT, pT size, and risk group

Variable	n *(%)*	*Overall 10-yr survival (%)*		P *value*
		Lobectomy	*Total thyroidectomy*	
pT stage				
T1	632 (71)	92	89	.78
T2	252 (29)	96	94	.62
pT size (cm)				
<1	354 (40)	89	93	.27
1–2	283 (32)	94	87	.11
2–3	164 (18)	98	94	.93
3–4	88 (10)	94	92	.53
Risk group				
Low	374 (42)	97	96	.58
Intermediate	457 (51)	90	85	.36
High	58 (7)	90	96	.35

despite a trend towards more aggressive surgical management and increased rates of postoperative RAI during the study period.[18] These results were confirmed on later analysis on risk stratified patients at the same institution.[5]

In contrast, there are other studies that have reported poorer outcome when patients are treated with thyroid lobectomy. For example, Loh et al[7] reviewed their experience of 700 patients treated at their institution over a 25-year period. They found that lobectomy or sub-total thyroidectomy resulted in increased rates of both recurrence and death compared with near total or total thyroidectomy. This analysis, however, included patients treated for recurrence, when treated primarily outside their institution, making interpretation of exact surgical details less accurate. They also excluded patients treated with T1N0M0 disease, who constitute a large part of oncologic thyroid surgical practice. Mazaferri et al[8]

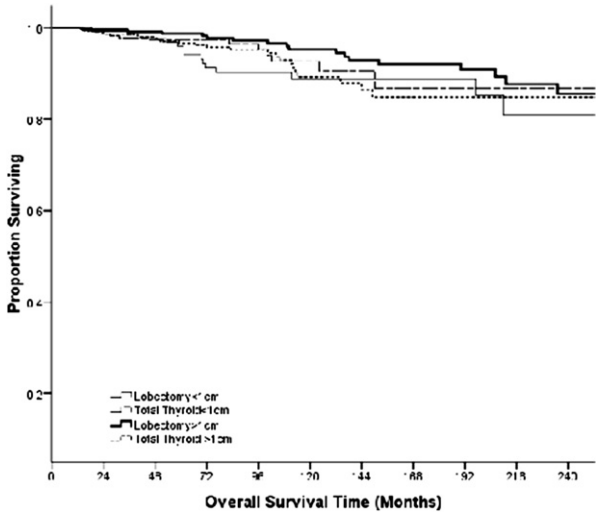

Fig 2. Overall survival by surgical treatment, stratified by pT size (<1 cm and >1 cm).

reviewed the outcomes of over 1000 patients treated at multiple institutions and found improved recurrence and survival rates in patients who underwent more extensive surgery. This effect was found to have an independent effect on survival on multivariate analysis. This group also chose to exclude patients with lesions under 1.5 cm from the analysis. A more recent study by Bilimoria et al[9] reporting on a large series of patients in the SEER database reported increased recurrence rates in thyroid lobectomy patients for all size of tumors compared to total thyroidectomy patients. Indeed, this study was considered when the ATA published recommendation 26 on the extent of surgery recommended for intrathyroid lesions over 1 cm in size.[10] Based on this evidence, the ATA guidelines now recommend total thyroidectomy for all lesions over 1 cm and lobectomy only for lesions under 1 cm in a low risk patient, which is also the recommendation of the consensus statement from the European Thyroid Cancer Taskforce.[19] The study by Bilimoria et al[9] has come under much scrutiny, however, and has been criticized for lacking inclusion of surgical details, pathology reports, and recurrence data. For example, there is no record of completeness of resection, extrathyroid extension, or histological subtypes of papillary cancer within the group. The locoregional recurrences were not classified into recurrence in the operated thyroid bed, the contralateral virgin lobe or recurrence in cervical lymph nodes. Other criticisms are that the data is from multiple centers, and there is no physician review of medical records.

Due to this controversy and the recent evidence showing that the rise in thyroid cancer is largely in

Table V. Characteristics of group treated with lobectomy stratified by need for further surgery

Variable	*No further surgery* n = *347* n *(%)*	*Further surgery* n = *14* n *(%)*	P *value*
Age			
<45 yr	186 (54)	9 (64)	.759
>45 yr	161 (46)	5 (36)	
Gender			
Male	79 (23)	3 (21)	.907
Female	268 (77)	11 (79)	
pT stage			
pT1	240 (69)	9 (64)	.700
pT2	107 (31)	5 (36)	
RAI			
No	346 (99)	14 (100)	NS
Yes	1 (1)	0 (0)	
Pathology (carcinoma)			
Papillary	299 (86)	13 (93)	.904
Follicular	35 (10)	0 (0)	
Hürthle cell	13 (4)	1 (7)	
Risk group			
Low risk	162 (47)	6 (43)	.945
Intermediate risk	151 (43)	8 (57)	
High risk	34 (10)	0 (0)	

RAI, Radioiodine ablation.

low risk patients with intrathyroidal T1T2 tumors,[1,2] we sought to revisit this topic by analyzing a more recent contemporary data set of patients from a database of 1810 WDTC patients managed at MSKCC between the years 1985 to 2005. In contrast to the Bilimoria study,[9] our data include accurate surgical, pathologic, and outcomes data. Identification and therefore exclusion of patients with extrathyroid spread may account for the different conclusions reached between our study and that of Bilimoria.[9] We also included all patients with intrathyroid disease, including those with pT1 lesions.

We report that for intraglandular cancers, the rates of death due to disease are below 1% over a period of 10 years in patients treated with either thyroid lobectomy or total thyroidectomy. Although for overall survival, advanced age and male gender were predictors of poor outcome in this group of patients, neither T stage, nor surgical procedure was significant on multivariate analysis. Our data show that the extent of surgical resection did not have any impact on overall or disease specific survival. In addition, there was no difference in either local or regional recurrence in patients with intraglandular cancer under 4 cm in size. We found no difference in tumors less than

1 cm, in keeping with the advice in the ATA guidelines.[10] In addition, despite recommendation 26 of ATA guideline,[10] we found no difference in outcomes for patients with tumors over 1 cm, as a whole group, or when stratified by 1–2 cm, 2–3 cm, and 3–4 cm. We did see a slightly higher rate of distant recurrence in the total thyroidectomy group; the reasons for this are unclear, but it was present despite lower rates of follicular carcinoma, lower rates of postoperative RAI, and longer median follow-up in the lobectomy group. This may relate to the higher median age in the total thyroidectomy group (48 years vs 44 years).

Unlike other groups, we considered the development of malignancy in a residual thyroid lobe following contralateral thyroid lobectomy as a contralateral recurrence rather than local recurrence. In our study, 21 of the 382 patients treated with initial lobectomy had immediate completion thyroidectomy based on the results of the surgical pathology. Of the remaining 361 patients treated by thyroid lobectomy alone, only 14 patients (4%) required a completion thyroidectomy at a later date; 7 patients (2%) developed a malignancy of the same histologic subtype in the contralateral lobe; 2 patients (0.7%) developed a malignancy of different histologic subtype in the contralateral lobe; and a further 5 patients (1.3%) had the contralateral lobe removed for benign nodules. Therefore, only 9 patients (2.7%) developed a malignancy in the contralateral lobe. This low incidence is good evidence to justify the policy of lobectomy adopted in these patients. In our study, we did not consider the development of the same histologic subtype of cancer in the contralateral lobe as a local recurrence. Even if we did, however, it would give a local recurrence rate of only 2%. Table V shows a comparison of patient and tumor characteristics for the lobectomy patients who did not require completion vs those who went on to have completion at a later date. We found no statistically significant difference between the groups. Therefore, there were no factors that could predict the need for completion thyroidectomy. From our data, we can conclude that after thyroid lobectomy, there is approximately a 6% chance of needing an immediate completion thyroidectomy but only a 4% chance of requiring completion at a later date.

In addition to similar outcome, thyroid lobectomy has also been shown to result in lower complication rates in large retrospective studies. The aim of our study was to report on survival outcomes following treatment rather than surgical complication rates and as such we do not report these data here. A recent study based on the Nationwide Inpatient Sample of surgeries performed in the U.S., 1999–2003, however, reported significantly higher rates of hypocalcemia (10.6% vs 3.5%), unilateral vocal cord palsy (1.1% vs 0.6%), and bilateral vocal cord palsy (0.4% vs 0.1%) following total thyroidectomy rather than thyroid lobectomy performed for malignancy.[20] An Italian study of 14,934 patients from 42 experienced endocrine surgery units reported symptomatic hypocalcemia rates of 14% following total thyroidectomy compared with 0.4% following thyroid lobectomy. They went on to report higher rates of both unilateral and bilateral recurrent laryngeal nerve palsy, tracheotomy, hemorrhage, and wound infection in the group treated with total thyroidectomy.[21] Experts in thyroid surgery report low rates of complications following both lobectomy and total thyroidectomy.[22] The studies above, however, report significant additional morbidity related to total thyroidectomy. This conflicting evidence supports the observation that the risks of thyroid surgery are related to the surgeon's experience of the procedure.

Our data do have limitations, however. As in all retrospective studies, we cannot exclude selection bias resulting from physician and patient preference. There is a trend towards total thyroidectomy in recent years due to increasing use of ultrasonography, which led to longer median follow-up in the patients treated with thyroid lobectomy. The thyroid lobectomy group was younger, which would be expected to result in improved outcomes. In contrast, the lobectomy group contained less papillary cancers and less patients receiving radioactive iodine, both of which may be expected to have a negative effect on outcomes. Despite these limitations, we can still conclude from our data that thyroid lobectomy gives similar excellent outcomes for all low risk and intermediate risk patients with intraglandular WDTC compared to total thyroidectomy.

Based on these results, thyroid lobectomy is a safe alternative to total thyroidectomy for T1T2 N0 WDTC. Our current practice at MSKCC for T1T2 N0 well differentiated thyroid cancer is to have an informed discussion with the patient about the options of thyroid lobectomy vs total thyroidectomy. If the thyroid mass is a single nodule less than 4 cm with no contralateral nodules in the opposite lobe, and no evidence of extrathyroidal extension, patients are given the option of thyroid lobectomy. We do not recommend central compartment neck dissection unless there are palpable nodes at the time of surgery or abnormal nodes are detected by preoperative ultrasonography.

REFERENCES

1. Enewold L, Zhu K, Ron E, Marrogi AJ, Stojadinovic A, Peoples GE, et al. Rising thyroid cancer incidence in the United States by demographic and tumor characteristics, 1980–2005. Cancer Epidemiol Biomarkers Prev 2009;18:784-91.
2. Chen AY, Jemal A, Ward EM. Increasing incidence of differentiated thyroid cancer in the United States, 1988–2005. Cancer 2009;115:3801-7.
3. Davies L, Welch HG. Increasing incidence of thyroid cancer in the United States, 1973–2002. JAMA 2006;295:2164-7.
4. Shah JP, Loree TR, Dharker D, Strong EW. Lobectomy versus total thyroidectomy for differentiated carcinoma of the thyroid: a matched-pair analysis. Am J Surg 1993;166:331-5.
5. Hay ID, Grant CS, Taylor WF, McConahey WM. Ipsilateral lobectomy versus bilateral lobar resection in papillary thyroid carcinoma: a retrospective analysis of surgical outcome using a novel prognostic scoring system. Surgery 1987;102:1088-95.
6. Sanders LE, Cady B. Differentiated thyroid cancer: reexamination of risk groups and outcome of treatment. Arch Surg 1998;133:419-25.
7. Loh KC, Greenspan FS, Gee L, Miller TR, Yeo PP. Pathological tumor-node-metastasis (pTNM) staging for papillary and follicular thyroid carcinomas: a retrospective analysis of 700 patients. J Clin Endocrinol Metab 1997;82:3553-62.
8. Mazzaferri EL, Jhiang SM. Long-term impact of initial surgical and medical therapy on papillary and follicular thyroid cancer. Am J Med 1994;97:418-28.
9. Bilimoria KY, Bentrem DJ, Ko CY, Stewart AK, Winchester DP, Talamonti MS, et al. Extent of surgery affects survival for papillary thyroid cancer. Ann Surg 2007;246:375-81.
10. Cooper DS, Doherty GM, Haugen BR, Kloos RT, Lee SL, Mandel SJ, et al. Revised American Thyroid Association management guidelines for patients with thyroid nodules and differentiated thyroid cancer. Thyroid 2009;19:1167-214.
11. AJCC cancer staging manual, version 6. New York: Springer; 2009.
12. Morris LG, Shaha AR, Tuttle RM, Sikora AG, Ganly I. Tall-cell variant of papillary thyroid carcinoma: a matched-pair analysis of survival. Thyroid 2010;20:153-8.
13. Shaha AR, Loree TR, Shah JP. Intermediate-risk group for differentiated carcinoma of thyroid. Surgery 1994;116: 1036-40.
14. Wong JB, Kaplan MM, Meyer KB, Pauker SG. Ablative radioactive iodine therapy for apparently localized thyroid carcinoma. A decision analytic perspective. Endocrinol Metab Clin North Am 1990;19:741-60.
15. Hassanain M, Wexler M. Conservative management of well-differentiated thyroid cancer. Can J Surg 2010;53: 109-18.
16. Barney BM, Hitchcock YJ, Sharma P, Shrieve DC, Tward JD. Overall and cause-specific survival for patients undergoing lobectomy, near-total, or total thyroidectomy for differentiated thyroid cancer. Head Neck 2011;33:645-9.
17. Chow TL, Choi CY, Lam SH. Disease control of differentiated thyroid carcinomas by hemithyroidectomy. Singapore Med J 2010;51:311-4.
18. Hay ID, Thompson GB, Grant CS, Bergstralh EJ, Dvorak CE, Gorman CA, et al. Papillary thyroid carcinoma managed at the Mayo Clinic during six decades (1940–1999): temporal trends in initial therapy and long-term outcome in 2444 consecutively treated patients. World J Surg 2002; 26:879-85.
19. Pacini F, Schlumberger M, Dralle H, Elisei R, Smit JW, Wiersinga W. European consensus for the management of patients with differentiated thyroid carcinoma of the follicular epithelium. Eur J Endocrinol 2006;154: 787-803.
20. Zerey M, Prabhu AS, Newcomb WL, Lincourt AE, Kercher KW, Heniford BT. Short-term outcomes after unilateral versus complete thyroidectomy for malignancy: a national perspective. Am Surg 2009;75:20-4.
21. Rosato L, Avenia N, Bernante P, De Palma M, Gulino G, Nasi PG, et al. Complications of thyroid surgery: analysis of a multicentric study on 14,934 patients operated on in Italy over 5 years. World J Surg 2004;28:271-6.
22. Clark OH, Levin K, Zeng QH, Greenspan FS, Siperstein A. Thyroid cancer: the case for total thyroidectomy. Eur J Cancer Clin Oncol 1988;24:305-13.